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**Citation for published version:**

Tripathi, A, Rankin, J, Aarvold, J, Chandler, C & Bell, R 2010, 'Preconception Counseling in Women with Diabetes: A Population-Based Study in the North of England', *Diabetes Care*, vol. 33, no. 3, pp. 586-588. <https://doi.org/10.2337/dc09-1585>

**Digital Object Identifier (DOI):**

[10.2337/dc09-1585](https://doi.org/10.2337/dc09-1585)

**Link:**

[Link to publication record in Edinburgh Research Explorer](#)

**Document Version:**

Publisher's PDF, also known as Version of record

**Published In:**

Diabetes Care

**Publisher Rights Statement:**

© Tripathi, A., Rankin, J., Aarvold, J., Chandler, C., & Bell, R. (2010). Preconception Counseling in Women with Diabetes: A Population-Based Study in the North of England. *Diabetes Care*, 33(3), 586-588. 10.2337/dc09-1585

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# Preconception Counseling in Women With Diabetes

A population-based study in the North of England

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**OBJECTIVE** — To investigate the association of preconception counseling with markers of care and maternal characteristics in women with pregestational diabetes.

**RESEARCH DESIGN AND METHODS** — The study includes data from a regional multi-center survey on 588 women with pregestational diabetes who delivered a singleton pregnancy between 2001 and 2004. Logistic regression was used to obtain crude and adjusted estimates of association.

**RESULTS** — Preconception counseling was associated with better glycemic control 3 months preconception (odds ratio 1.91, 95% CI 1.10–3.04) and in the first trimester (2.05, 1.39–3.03), higher preconception folic acid intake (4.88, 3.26–7.30), and reduced risk of adverse pregnancy outcome ( $P = 0.027$ ). Uptake of preconception counseling was positively associated with type 1 diabetes (1.87, 1.14–3.07) and White British ethnicity (2.56, 1.17–5.6) and negatively with deprivation score (0.78, 0.70–0.87).

**CONCLUSIONS** — Efforts are needed to improve preconception counseling rates. Uptake is associated with maternal sociodemographic characteristics.

*Diabetes Care* 33:586–588, 2010

Rates of preconception counseling in women with diabetes remain low despite the recognized importance of adequate preparation for pregnancy in national guidance (1,2). This study reports the association of preconception counseling with markers of adequate preconception care and pregnancy outcome and investigates maternal characteristics related to its uptake in a population-based cohort in the North of England.

## RESEARCH DESIGN AND METHODS

— Data were extracted from the Northern Diabetes in Pregnancy Survey (NorDIP) database maintained at the Regional Maternity Survey Office, Newcastle upon Tyne, U.K. NorDIP is an ongoing prospective audit of all pregnan-

cies within the region complicated with pregestational diabetes (3). The survey was initially approved by Newcastle Research Ethics Committee, and data are now held with informed consent. All singleton pregnancies delivered between 1 January 2001 and 31 December 2004 ( $n = 588$ ) were included. Cases from 2002 were previously included in a national cohort study (4). Data included information regarding periconceptual care, sociodemographic characteristics, and pregnancy outcome.

Logistic regression was used to explore the association between preconception counseling and markers of adequate preconception care: preconception and first trimester A1C  $\leq 7\%$ , A1C recorded within 3 months of conception, folic acid

taken before conception, and hospital booking at  $\leq 8$  weeks of gestation. Each multivariable model was controlled for type of diabetes and sociodemographic characteristics. Exact binomial test of proportions was used to assess the association between preconception counseling and adverse outcomes of interest, defined as major congenital anomaly and/or perinatal death.

We assessed the relationship between uptake of preconception counseling and maternal characteristics: type of diabetes, maternal age at delivery, parity (primipara/multipara), ethnicity (white British/others), Index of Multiple Deprivation (IMD) score as a proxy for socioeconomic status, and hospital of booking. IMD score is an area-based deprivation score calculated from seven routinely collected indexes, where increasing score denotes greater deprivation (5). The initial multivariable logistic regression model was reduced to obtain the final parsimonious model by backward elimination (Table 1). The  $-2 \log$ -likelihood test ( $\chi^2 = 687.209-687.141$ ;  $\chi^2_{d.f. = 1, 0.95} = 3.841$ ) indicated that the final parsimonious model is better.

Statistical analyses were performed with SAS 9.1 (SAS Institute, Cary, NC) using  $\alpha \leq 0.05$  and a two-sided test.

**RESULTS** — Of the 588 women, 448 (77%) had type 1 diabetes, 527 (90%) were white British, 208 (36%) were primipara, and the mean maternal age at delivery was  $29.6 \pm 6.3$  years (mean  $\pm$  SD). About half ( $n = 297$ ) of the women did not receive preconception counseling and 55% ( $n = 325$ ) did not take preconception folic acid; preconception A1C record was missing for 276 (47%) women; and of those with records, 74% had suboptimal glycemic control (A1C  $> 7\%$ ).

Preconception counseling was significantly associated with the following: better glycemic control within 3 months preconception (odds ratio [OR] 1.91, 95% CI 1.10–3.04;  $P = 0.002$ ) and in the first trimester (2.05, 1.39–3.03;  $P < 0.001$ ), folic acid intake within 3 months preconception (4.88, 3.26–7.30;  $P <$

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Received 25 August 2009 and accepted 19 December 2009. Published ahead of print at <http://care.diabetesjournals.org> on 29 December 2009. DOI: 10.2337/dc09-1585.

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Table 1—Association of preconception counseling with markers of preconception care and maternal characteristics

	Yes (n = 240)	No (n = 297)	Crude OR (95% CI)*	P	Adjusted OR (95% CI)†	P
Preconception glycemic control						
A1C ≤7%	51 (63.8)	29 (36.3)	1.87 (1.12–3.17)	0.019	1.91 (1.10–3.04)	0.002
A1C >7%	109 (48.2)	117 (51.8)	1.00		1.00	
Folic acid intake						
3 months preconception	134 (68.4)	62 (31.6)	5.04 (3.42–7.44)	<0.001	4.88 (3.26–7.30)	<0.001
Postconception	94 (30.4)	215 (69.6)	1.00		1.00	
Gestation at hospital booking						
≤8 weeks	153 (51.2)	146 (48.8)	1.87 (1.32–2.66)	<0.001	1.80 (1.26–2.57)	0.001
>8 weeks	87 (36.6)	151 (63.4)	1.00		1.00	
First trimester glycemic control						
A1C ≤7%	108 (55.4)	87 (44.6)	1.89 (1.31–2.73)	<0.001	2.05 (1.39–3.03)	<0.001
A1C >7%	117 (39.6)	178 (60.4)	1.00		1.00	
Preconception A1C record						
Yes	160 (52.3)	146 (47.7)	2.14 (1.50–3.04)	<0.001	2.11(1.47–3.02)	<0.001
No	80 (34.6)	151 (65.4)	1.00		1.00	
Type of diabetes						
Type 1	202 (48.4)	215 (51.6)	2.08 (1.35–3.21)	<0.001	1.87 (1.14–3.07)	0.014
Type 2	37 (31.1)	82 (68.9)	1.00		1.00	
IMD score‡	29.0 ± 17.1	36.0 ± 17.8	0.80 (0.72–0.88)	<0.001	0.78 (0.70–0.87)	<0.001
Ethnicity						
White British	229 (46.4)	265 (53.4)	2.50 (1.23–5.10)	0.011	2.56 (1.17–5.60)	0.019
Others§	11 (25.6)	32 (74.4)	1.00		1.00	
Parity						
Multiparous	157 (44.7)	194 (55.3)	1.00 (0.70–1.43)	0.971		
Primiparous	82 (46.6)	102 (55.4)	1.00			
Maternal age at delivery	29.1 ± 6.0	29.3 ± 6.6	1.07 (1.00–1.05)	0.268	1.02 (0.99–1.05)	0.244

Data are n (%) for categorical and mean ± SD for continuous variables, ORs (95% CI), or P. \*Unadjusted ORs were obtained from simple logistic regression. †Adjusted ORs were obtained by multivariable logistic regression; for markers of preconception care (PC) (preconception and first trimester glycemic control, folic acid intake, gestation at booking, and A1C record), each model contains preconception counseling as the predictor and demographic variables as covariates; and for predictors of PC uptake, the OR represents final parsimonious model with type of diabetes, IMD score, ethnicity, age at delivery, and hospital of booking as the predictor variable. Interactions between the main variable of interest: type of diabetes and other covariates were nonsignificant and are not included in the model. The variable “hospital of booking” comprised 14 maternity units (not presented in the table); it was a significant predictor in the final model (type 3: d.f. = 13;  $\chi^2$  = 33.2;  $P$  = 0.002). ‡OR for the 10-point increase in IMD score. §Other ethnicity included black and minority ethnic (BME) groups. Percentages may not total 100% due to rounding or missing values.

0.001), hospital booking at ≤8 weeks of gestation (1.78, 1.26–2.57;  $P$  = 0.001), and preconception A1C recorded (2.11, 1.47–3.02;  $P$  < 0.001) (Table 1). There were a total of 45 adverse outcomes: 10 perinatal deaths and 36 with major congenital anomaly. Of those with records, 10% ( $n$  = 30/297) of women who did not receive preconception counseling had adverse outcome compared with 6% ( $n$  = 14/240) in those who did. Exact binomial test showed that adverse outcome is more likely in women without counseling ( $P$  = 0.027).

In the final model, odds of preconception counseling uptake increased in type 1 diabetes (OR 1.87, 95% CI 1.14–3.07;  $P$  = 0.014) and white British ethnicity (2.56, 1.17–5.6;  $P$  = 0.019) and decreased with higher IMD score (0.78, 0.70–0.87;  $P$  < 0.001) (Table 1). Rate of preconception counseling varied from 30 to 59% in the 14 participating hospitals of

booking, a significant confounder in the model (type 3: df = 13;  $\chi^2$  = 33.2;  $P$  = 0.002), whereas maternal age was nonsignificant.

**CONCLUSIONS**— Preconception counseling rates and indicators of adequate preparation for pregnancy were low compared with national standards (1), but are consistent with findings reported from the U.K. and other settings (2).

In our study, as in others (6–9), women receiving preconception counseling had better indicators of care. These results agree with recent studies and clinical trials. In a recent clinical trial, proactive counseling of young girls with type 1 diabetes showed sustained improvement in knowledge about well-planned pregnancy; while in another trial, it was associated with better outcomes (7,8). This suggests that preconception counseling could significantly promote a well-

planned pregnancy. However, it is hard to comment if intention to seek preconception counseling is a residual confounder, since women who proactively attend preconception counseling are likely to have prepared carefully for their pregnancy. A high proportion of pregnancies in women with diabetes, however, are known to be unplanned (2,10), and this is a challenge to achieving high rates of attendance for preconception counseling.

We found that women with type 1 diabetes, those of white British ethnicity, and those of higher socioeconomic status were more likely to receive preconception counseling. Recent national and international studies have shown similar results (2,11,12). In England, type 2 diabetes is frequently managed in a primary care setting and type 1 diabetes within a specialist hospital setting; thus, the former may be less aware of hospital-based preconception services. Nonetheless, this is of concern

as the number of pregnancies complicated with type 2 diabetes is rising in the U.K. and other developed countries (2,3).

The major strength of our study is that the NorDIP is a continuous prospective survey, and all maternity units within the area contribute. Limitations included 47% missing data for preconception A1C value and lack of detailed content and delivery format of preconception counseling.

Preconception counseling may play an important role in achieving adequate preconception preparation and optimizing outcome in women with pregestational diabetes. Greater effort is needed to improve both the provision and uptake of preconception counseling, and particular consideration should be made to facilitate access to adequate preconception services for women with type 2 diabetes, from minority ethnic groups and in women living in deprived areas.

**Acknowledgments**— We thank Danielle Crowder, Mary Bythell, and staff at the Regional Maternity Survey Office; the Northern Diabetes in Pregnancy Survey (NorDIP) coordinators and lead clinicians for their continued collaboration and support of the NorDIP; and Drs. Wilfried Karmaus and Hongmei Zhang at the University of South Carolina for detailed review of the manuscript. Maternity units that participated in the NorDIP include Bishop Auckland Hospital, Cumberland Infirmary, Darlington Memorial Hospital, University Hospital of Hartlepool, University Hospital

North Durham, University Hospital of North Tees, North Tyneside General Hospital, Queen Elizabeth Hospital Gateshead, Royal Victoria Infirmary Newcastle-upon-Tyne, James Cook University Hospital, South Tyneside District Hospital, Sunderland Royal Hospital, Wansbeck General Hospital, and West Cumberland Hospital. J.R. was funded by a Personal Award Scheme Career Scientist Award from the U.K. National Institute of Health Research.

No potential conflicts of interest relevant to this article were reported.

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